CLAIMS

We claim:

1. A coupler comprising:

a saddle;

a channel, wherein said channel comprises a first end having a substantially elliptical cross-section connected to said saddle and a second end having a substantially circular cross-section;

a tissue clamp positioned around said channel; and

a flange formed adjacent to said second end of said channel.

2. The coupler of claim 1, wherein said tissue clamp comprises a shape-memory alloy.

3. The coupler of claim 2, wherein said shape-memory alloy comprises a nickel titanium alloy.

4. The coupler of claim 1, wherein said tissue clamp comprises a plurality of teeth positioned along a periphery of said tissue clamp.

5. The coupler of claim 1, wherein said tissue clamp comprises a plurality of dimpled holes formed therethrough.

6. The coupler of claim 1, wherein a cross-sectional area of said channel remains substantially constant as said channel transitions from said first end to said second end.

7. The coupler of claim 1, wherein a cross-sectional area of said channel increases or decreases as said channel transitions from said first end to said second end.

8. The coupler of claim 1, further comprising a mating surface formed adjacent to said flange.

9. The coupler of claim 1, wherein said tissue clamp comprises a pair of legs, which extend and position said tissue clamp adjacent to said saddle when said tissue clamp is heated to a transition temperature.

10. The coupler of claim 1, wherein said tissue clamp is made from a material having an austenitic transition temperature less than about 10°C.

11. The coupler of claim 1, wherein said tissue clamp is made from a material having an austenitic transition temperature about equal to or slightly greater than body temperature.

12. The coupler of claim 10, wherein said material is nitinol.

13. A method of connecting two conduits comprising the steps of:

positioning a first saddle of a first coupler within a first conduit;

positioning a second saddle of a second coupler within a second conduit;

clamping said first conduit to said first saddle of said first coupler;

clamping said second conduit to said second saddle of said second coupler; and

connecting said first coupler and said second coupler.

14. The method of claim 13, further comprising the step of making an incision in said first conduit and positioning said saddle of said first coupler within said first conduit.

15. The method of claim 13, further comprising the step of making an incision in said second conduit and positioning said saddle of said second coupler within said second conduit.

16. The method of claim 13, wherein the step of clamping said first conduit to said first saddle comprises the step of heating a first tissue clamp to a transition temperature, such that said first tissue clamp secures said first conduit between said first tissue clamp and said first saddle.

17. The method of claim 13, wherein the step of clamping said second conduit to said second saddle comprises the step of heating a second tissue clamp to a transition temperature, such that said second tissue clamp secures said second conduit between said second tissue clamp and said second saddle.

18. The method of claim 13, wherein the step of clamping said first conduit to said first saddle comprises the step of extending a pair of legs formed in said first tissue clamp, such that said first tissue clamp secures said first conduit between said first tissue clamp and said first saddle.

19. The method of claim 13, wherein the step of clamping said second conduit to said second saddle comprises the step of extending a pair of legs formed in said second tissue clamp, such that said second tissue clamp secures said second conduit between said second tissue clamp and said second saddle.

20. The method of claim 13, wherein the step of connecting said first coupler and said second coupler comprises the steps of:

positioning a first flange of said first coupler in alignment with a second flange of said second coupler; and

crimping a clamping ring around said first flange and said second flange to secure said first coupler and said second coupler together.

21. The method of claim 20, wherein the step of positioning a first flange of said first coupler in alignment with a second flange of said second coupler comprises the step of

engaging a first mating surface of said first coupler and a second mating surface of said second coupler.

22. The method of claim 13, wherein the step of connecting said first coupler and said second coupler precedes the steps of positioning said first saddle and said second saddle in said first conduit and said second conduit, respectively.

23. A conduit coupling device comprising:

a first coupler comprising a first saddle, a first channel, a first tissue clamp, and a first flange;

a second coupler comprising a second saddle, a second channel, a second tissue clamp, and a second flange;

a clamping ring for securing said first flange and said second flange together.

24. The conduit coupling device of claim 23, wherein said first channel and said second channel have substantially constant cross-sectional area.

25. The conduit coupling device of claim 23, wherein said first channel and said second channel have varying cross-sectional areas.

26. The conduit coupling device of claim 23, further comprising a first mating surface formed adjacent to said first flange and a second mating surface formed adjacent to said second flange.

27. The conduit coupling device of claim 23, wherein said first tissue clamp and said second tissue clamp comprise a shape-memory alloy.

28. The conduit coupling device of claim 23, wherein each of said first tissue clamp and said second tissue clamp comprise a plurality of dimpled holes formed therethrough.

29. The conduit coupling device of claim 23, wherein said first tissue clamp and said second tissue clamp comprise a plurality of teeth positioned along a periphery of said first tissue clamp and said second tissue clamp.

30. The conduit coupling device of claim 23, wherein said first channel comprises a first end of substantially elliptical cross-section connected to said first saddle and a second end of substantially circular cross-section adjacent to said first flange.

31. The conduit coupling device of claim 23, wherein said second channel comprises a first end of substantially elliptical cross-section connected to said second saddle and a second end of substantially circular cross-section adjacent to said second flange.

32. The conduit coupling device of claim 23, wherein said first coupler may be positioned at varying positions relative to said second coupler, so that said first saddle and said second saddle may be positioned at varying positions relative to one another.

33. The conduit coupling device of claim 23, wherein said first channel comprises a first end of substantially circular cross-section connected to said first saddle and a second end of substantially circular cross-section adjacent to said first flange.

34. A coupler holder and delivery device for holding and delivering a coupler into a blood vessel, said coupler comprising a saddle; a channel, wherein said channel comprises a first end connected to said saddle and a second end; a tissue clamp positioned around said channel; and a flange formed adjacent to said second end of said channel, said coupler holder and delivery device comprising:

an outer tube surrounding an inner shaft, such that said outer tube is slidable on said inner shaft and independently of said inner shaft;

a coupler conforming end, which is mounted on a first end of said inner shaft and is adapted to engage said second end of said channel of said coupler; and

a pair of opposing, tissue clamp receiving flanges mounted on opposite sides of a first end of said outer tube and adapted to engage said tissue clamp bend said tissue clamp away from said saddle, wherein said outer tube is slidable toward said first end of said inner shaft to engage said flanges to said tissue clamp, and wherein said outer tube is slidable away from said first end of said inner shaft to release said tissue clamp from said flanges.

35. A method for delivering a coupler into a blood vessel, said coupler comprising a saddle; a channel, wherein said channel comprises a first end connected to said saddle and a second end; a tissue clamp positioned around said channel; and a flange formed adjacent to said second end of said channel, said method comprising the steps of:

engaging said channel of said coupler;

engaging said tissue clamp and bending said tissue clamp away from said saddle;

making an incision into said blood vessel;

delivering said coupler into said blood vessel through said incision;

securing said saddle to said blood vessel; and

releasing said tissue clamp, so that said tissue clamp conforms to said saddle.

36. A system for performing vascular surgery, comprising:

a first retractor blade and a second retractor blade, wherein said first retractor blade comprises a first grasping bar and said second retractor blade comprises a second grasping

bar and wherein said first retractor blade and said second retractor blade are adapted to engage opposing edges of an incision in a patient;

a fulcrum device comprising a first fulcrum slot and a second fulcrum slot formed through opposing edges of said fulcrum device, wherein said first fulcrum slot is adapted to receive said first grasping bar and said second fulcrum slot is adapted to receive said second grasping bar, such that said fulcrum device is adapted to apply leverage from said first retractor blade and said second retractor blade to spread the edges of the incision and to allow access to a chest cavity of the patient.

37. The system of claim 36, further comprising a first bar and a first mounting bracket and a second bar and a second mounting bracket, wherein said first retractor blade is mounted adjustably and pivotably on said first bar by said first mounting bracket and said second retractor blade is mounted adjustably and pivotably on said second bar by said second mounting bracket, whereby a separation between the first retractor blade and said second retractor blade is adjustable to increase or decrease the separation between the edges of the incision in the patient.

38. The system of claim 36, further comprising a surgical table comprising a central support for supporting the patient's head and trunk, a pair of arm supports extending from opposing edges of said central support, and a pair of leg supports for supporting and separating the patient's legs, whereby an angle of separation between the patient's legs is adjustable to permit improved access to the patient's chest by a surgeon standing between the patient's legs.

39. The system of claim 38, further comprising a first bar and a first mounting bracket and a second bar and a second mounting bracket, wherein said first retractor blade is mounted adjustably and pivotably on said first bar by said first mounting bracket and said second retractor blade is mounted adjustably and pivotably on said second bar by said second mounting bracket and wherein said first bar and said second bar are mounted on said surgical table, whereby a separation between the first retractor blade and said second retractor blade is adjustable.

40. The system of claim 36, wherein said fulcrum device further comprises a perimeter lip having an (window-like) access opening formed therewithin, a pair of parallel first rails

which extend across said access opening, and an instrument support slidably mounted between said pair of parallel first rails, such that said instrument support holds a surgical instrument inserted into the patient's chest cavity.

41. The system of claim 40, wherein said instrument support further comprises a pair of first grasping runners, which slidably engage said pair of parallel first rails; a pair of parallel second rails which extend between said pair of first grasping runners; and an instrument port slidably mounted between said pair of parallel second rails, whereby said instrument port is positionable within said access opening along a first axis parallel to said pair of parallel first rails and along a second axis parallel to said pair of parallel second rails and perpendicular to said first axis.

42. The system of claim 41, wherein said instrument port further comprises a pair of second grasping runners which slidably engage said pair of parallel second rails and an instrument access orifice formed therethrough, such that said instrument access orifice receives a surgical instrument and holds it at a position within said access opening.

43. The system of claim 36, wherein said fulcrum device further comprises a light source to illuminate the chest cavity.

44. The system of claim 43, wherein said light source comprises a plurality of light emitting diodes arrayed about a side of said perimeter lip facing the patient's chest cavity.

45. The system of claim 43, wherein said light source comprises at least one fiber optic cable to convey light to a plurality of fiber optic cable ends arrayed about a side of said perimeter lip facing the patient's chest cavity.

46. The system of claim 36, wherein said fulcrum device further comprises at least one fulcrum passage and wherein a heart blade, wherein said at least one fulcrum passage is adapted to receive said heart blade therethrough, whereby said heart blade positions the patient's heart during surgery.

47. The system of claim 38, wherein said surgical table further comprises a video monitor and a camera, whereby images of the patient's chest cavity are displayed on said video monitor.

48. The system of claim 36, further comprising an endoscope and an endoscope holding device, wherein said endoscope holding device comprises a first ball joint, a second ball joint, and a manipulating shaft extending between said first ball joint and said second ball joint; an endoscope stabilizing device supporting said second ball joint, whereby said endoscope holding device is fixed to a stationary object; a handle mounted on said first ball joint comprising a passage formed therethrough for receiving said endoscope and a activating lever, whereby said first ball joint and said second ball joint are released and secured.

49. The system of claim 48, further comprising a first bar and a first mounting bracket and a second bar and a second mounting bracket, wherein said stationary object is selected from the group consisting of said first bar and said second bar and wherein said first retractor blade is mounted adjustably and pivotably on said first bar by said first mounting bracket and said second retractor blade is mounted adjustably and pivotably on said second bar by said second mounting bracket, whereby a separation between the first retractor blade and said second retractor blade is adjustable.

50. The system of claim 48, wherein said endoscope further comprises a camera.

51. The system of claim 36, further comprising a dissecting instrument for separating tissue, said dissecting instrument comprising a handle, a shaft, and a tip, wherein said shaft is rotatable and said tip is rotatable and pivotable on said shaft and wherein said tip comprises dissecting means.

52. The system of claim 51, wherein said dissecting means comprises a spatula end affixed to a spatula end shaft and a grasper jaw affixed to said spatula end shaft, such that said grasper jaw is brought into contact with said spatula end to blunt dissect tissue positioned therebetween.

53. The system of claim 50, wherein a first button mounted on said handle is manipulated to pivot said tip via mechanical couplings within said shaft.

54. The system of claim 52, wherein a second button mounted on said handle is manipulated to actuate said grasper jaw via mechanical couplings within said shaft.

55. The system of claim 51, wherein said dissecting means comprises a source of $CO_2$ and a gas flow passage for conveying $CO_2$ to said tip, whereby a flow of $CO_2$ separates impacted tissue into natural tissue planes prior to dissection.

56. The system of claim 51, wherein said dissecting means comprises a source of RF energy and a conduit for conveying RF energy to an innermost surface of spatula end shaft.

57. The system of claim 56, wherein a second button mounted on said handle is manipulated to actuate said grasper jaw via mechanical couplings within said shaft to seize tissue to coagulate blood in said tissue prior to dissection.

58. The system of claim 51, wherein said dissecting means comprises a spatula end affixed to a spatula end shaft and a grasper jaw affixed to said spatula end shaft, such that said grasper jaw is brought into contact with said spatula end to blunt dissect tissue positioned therebetween; a source of $CO_2$ and a gas flow passage for conveying $CO_2$ to said tip, whereby a flow of $CO_2$ separates impacted tissue into natural tissue planes prior to dissection; and a source of RF energy and a conduit for conveying RF energy to an innermost surface of spatula end shaft.

59. The system of claim 36, further comprising a cannula comprising a stabilizer and manipulation component and a catheter component.

60. The system of claim 59, wherein said stabilizer and manipulation component is adapted to receive said catheter component and comprises a suction cup adapted to secure said stabilizer and manipulation component to an apex of the patient's heart; a suction tube through which fluid is drawn to create suction between said suction cup and the heart; a stabilizer shaft which passes through said suction cup and is adapted to penetrate the heart through an incision; a hemostatic valve in communication with said stabilizer shaft for insertion of said catheter component into the heart; and a manipulator arm and handle for guiding said suction cup into contact with the heart.

61. The system of claim 59, wherein said catheter component is adapted to be received by said stabilizer and manipulation component and comprises at least one catheter tube adapted to pass through said stabilizer and manipulation component in to the patient's heart; a proximal balloon, which deploys radially in the left ventricle; a distal balloon that deploys radially in the ascending aorta, at least one radial discharge opening formed in said at least

one catheter tube between said distal balloon and said proximal balloon; and a distal discharge opening formed at the tip of said at least one catheter tube.

62. The system of claim 60, wherein said catheter component is adapted to be received by said stabilizer and manipulation component and comprises at least one catheter tube adapted to pass through said stabilizer and manipulation component in to the patient's heart; a proximal balloon, which deploys radially in the left ventricle; a distal balloon that deploys radially in the ascending aorta, at least one radial discharge opening formed in said at least one catheter tube between said distal balloon and said proximal balloon; and a distal discharge opening formed at the tip of said at least one catheter tube.

63. The system of claim 36, further comprising tissue scissors comprising a scissors handle, a scissors shaft, a distal end pivotable on said scissors shaft at a distal end joint; a slidable button mounted on said scissors handle and operably connected to said distal end joint, whereby said distal end is pivoted; a pair of scissor blades mounted on said distal end; and a handle ring operably connected to at least one of said pair of scissor blades, whereby at least one of said pair of scissor blades in urged into contact with the other of said pair of scissor blades.

64. The system of claim 63, wherein said tissue scissors further comprises a source of RF energy and a conduit for conveying RF energy to at least one of said pair of scissor blades.

65. The system of claim 36, further comprising a coupler connection device for connecting a pair of couplers to each other, comprising a connection shaft, a pair of coupler connecting arms, and a connecting pivot; wherein each of said coupler connecting arms further comprises a pair of arched fingers positioned at the end of said coupler connecting arm opposite said connecting pivot, which grasp one of said pair of couplers, and wherein at least one of said pair of coupler connecting arms pivots on said connecting pivot towards the other of said pair of coupler connecting arms to connect said couplers to each other.

66. A method of performing vascular surgery, comprising the steps of:

making a subcostal incision in a patient;

engaging opposing edges of said incision with a first retractor blade and a second retractor blade;

mounting a fulcrum device on said first retractor blade and said second retractor blade;

retracting said incision to provide access to the patient's chest cavity through which to operate;

placing a heart blade through said fulcrum device;

inserting an endoscope through said fulcrum device to locate damage in a coronary vessel;

positioning the heart with said heart blade to expose said damaged coronary vessel and a branch of the Internal Mammary Artery (IMA);

inserting a cannula through said fulcrum device into the apex of the patient's heart to place the patient on cardiopulmonary bypass;

making a vessel incision in said coronary vessel downstream from said located damage in said coronary vessel and inserting a first conduit coupler into said vessel incision;

making an IMA incision in said IMA and inserting a second conduit coupler into said IMA incision;

connecting said first conduit coupler to said second conduit coupler;

removing said cannula from the patients heart; and

supplying blood to tissue downstream of said located damage via said first conduit coupler and said second conduit coupler.